U.S. Department of Energy • Office of Fossil Energy • National Energy Technology Laboratory

netlog

The NETL newsletter

The December 2006 NETL Newsletter

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NETL Partners on Novel Helicopter Magnetic and Gas-Sensing Survey

NETL, RMOTC, and Fugro Airborne Surveys are collaborating in a novel helicopter magnetic and gas-sensing survey at Naval Petroleum Reserve No. 3 near Midwest, WY, using aeromagnetics to make a comprehensive inventory of wells, pipelines, and other oilfield infrastructure. Sensors on board during the flight also will measure methane emissions from various sources including wellheads, pipelines, production facilities, and produced water ponds. This survey will build upon the highly successful helicopter well-finding survey at the nearby Salt Creek Oilfield that was conducted in FY06 by NETL and Fugro Airborne Surveys. An additional flight will be conducted over certain pipeline segments to test a new technology that evaluates the effectiveness of cathodic protection. Funds for the airborne survey will be provided by RMOTC.

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NETL Assists in Meeting Challenge Posed by Improvised Explosive Devices (IEDs)

As a result of a presentation by NETL staff to Army Research Laboratory personnel in Aberdeen, MD, Army officials have requested NETL-developed cast steel armor plate samples for use on targets during ballistic tests. If test results are favorable, NETL has agreed to supply, on a cost-reimbursable basis, a number of full-size prototype armor plates for field-testing. The novel armor holds great promise for protecting heavy convoy vehicles and personnel that are being destroyed or disabled by IEDs and other roadside bombs.

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Tests Show Prototype Fuel Cell Exceeds Phase I Goals of Solid State Energy Conversion Alliance (SECA)

Preliminary results based on 1,715 hours of operation show that the prototype unit developed by the SECA Industry Team led by FuelCell Energy achieved an average power of approximately 2,800 watts with net system efficiency of 37 percent and a degradation rate of about 3.5 percent per thousand

hours. These performance levels exceed the SECA Phase I Program minimum requirements of 35 percent efficiency and 4 percent degradation per thousand hours. Testing was conducted in the NETL Fuel Cell Test facility using pipeline natural gas fuel and exporting electricity to the grid to support NETL power needs. The facility is designed to provide independent verification of the performance and efficiency of prototype units developed by SECA, the U.S. Department of Energy's Fossil Energy flagship solid oxide fuel cell technology development program.

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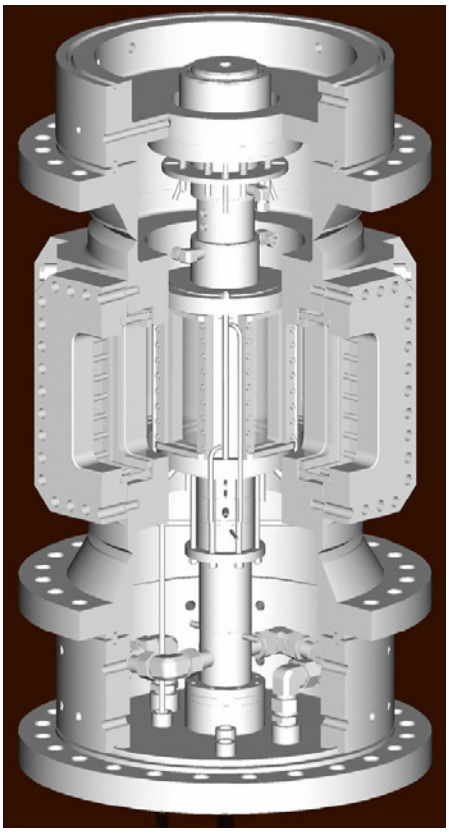

Researchers Test Hydrogen Dilute Diffusion Combustion Concept at Pressure

Researchers at NETL recently completed initial experimental testing of the lab's hydrogen dilute diffusion concept in the low-emissions combustion test and research (LECTR)/SimVal facility. The concept is being studied as a potential low-emission combustion approach for FutureGen, a U.S. Government project to build a zero-emissions power plant that produces hydrogen and electricity from coal and sequesters carbon dioxide. NETL's hydrogen dilute diffusion concept combines diffusion combustion to reduce flashback propensity with nitrogen dilution to reduce flame temperature and lower NOx emissions. The NETL approach uses high flame strain rates to further reduce NOx emissions. The results have demonstrated that the dilute hydrogen diffusion concept using nitrogen as a diluent is a viable high-pressure combustion approach.

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Eighth Arc Furnace Smelting Test Completed to Produce Metallurgical-Grade Silicon with Lower Impurities

Under a full-cost-recovery CRADA between NETL and Dow Corning, NETL scientists are working with Dow Corning to develop a process to produce metallurgical-grade silicon suitable for photovoltaic applications. As part of this effort, NETL scientists designed and installed an innovative silicon-smelting electric arc furnace. Since January 2006, a number of baseline tests on standard feed consisting of quartz, charcoal, and wood chips have been performed to develop an effective smelting practice and determine baseline-smelting parameters. Utilizing data generated from the previous trials, the latest smelting trial was completed in mid-October using quartz, woodchips, and a new proprietary high-purity carbon briquette to produce acceptable high-purity silicon. Dow Corning recently announced that it has achieved a milestone in solar energy technology: a solar-grade silicon derived from metallurgical silicon that exhibits good solar cell characteristics.

The new briquettes tested in this latest trial produced a higher purity silicon at an energy consumption comparable to or lower than that from the baseline runs. These latest tests show promise to produce an even lower cost, acceptable solar-grade silicon. Dow technical

representatives are very optimistic that the latest variation in the process will be even more successful than previously believed possible.

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Corrosion Probes Begin Field Test at Commercial Boiler Site

Fireside corrosion probe performance is being monitored by NETL scientists at a commercial waste-to-energy combustion site in Brooks, OR. Four probes designed by NETL scientists to help operators understand and monitor real-time corrosion behavior in boiler environments were installed at the end of October at the facility owned and operated by Covanta Energy, Inc. The corrosion probes, which are engineered to measure temperature and the electrochemical corrosion rate in environments typical of those found in combustion boilers, will be utilized by the plant operator to monitor the corrosivity of the process environment and to indicate the remaining service life of critical metallic components. Utilizing information provided by the corrosion probes, the plant operator also will have the opportunity to select process conditions that can result in reduced wastage of boiler components. Ultimately, corrosion probe data may also be used as a tool to more accurately schedule required maintenance shutdowns. NETL scientists expect the probes to see up to six months of service before being removed during the next maintenance period for postmortem evaluation. Here are links to related articles regarding electrochemical corrosion rate probes and monitoring power plant corrosion.

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NETL Initiates Collaboration to Assess Performance of Drill Bits Being Developed for the Oil and Gas Industry

Utilizing the unique wear-testing capabilities of NETL, scientists have begun assessing the tribological performance of a suite of potential drill bit materials being developed by Smith Bits International of Houston, TX, for the oil and gas industry. NETL will determine the performance of these materials in environments that include both impact and abrasion. The collaboration takes advantage of NETL's capability, which is unique in the United States, to assess the wear behavior of materials.

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University Research Initiative Program

NETL, WVU Collaborate on Lubricant Formulations Assessment for Hydrogen-Fueled Engines

Engineers from NETL's Office of Research and Development met with researchers from West Virginia University to discuss the current status and future plans for their collaborative effort to determine the effect of lubricating oil formulation on the performance of hydrogen-fueled reciprocating engines. Lubricating oil is the major source of pollutant emissions in hydrogen-fueled engines, and lubricant degradation in hydrogen-fueled engines is an important cause of performance degradation. The collaboration brings WVU's expertise in engine testing and emissions measurement together with NETL's hydrogen engine test capabilities. WVU has been in contact with a number of oil manufacturers and has secured two oil formulations designed for use with hydrogen engines. Valvoline supplied the lube oils at no cost to the project. Testing in NETL's Reciprocating Engine Laboratory will examine the effect of these oil formulations on pollution and engine performance.

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Project Focuses on Nanofluids Development for Potential Oil and Gas Deep-Hole Drilling

A collaborative research project on specialty nanofluids has been developed by NETL, Carnegie Mellon University, and West Virginia University researchers, focusing on developing specialty nanofluids for oil and gas applications. By enhancing thermal conductivity, nanofluids could improve downhole separation. Weighting agents may be added to the fluid to increase its density, and thus the pressure it exerts on the walls of the borehole. Drag-reducing polymer additives

can be added with nanoparticles to improve drilling penetration rate; to clean, lubricate, and cool the drill bit to keep the process moving along smoothly: and to extend the life of the drill bit. Thus, nanofluids could significantly improve drilling speed and eliminate damage to the reservoir rock in the well, making it possible to extract more oil. NETL researchers will produce the nanoparticles by laser ablation (in liquids) of metals and non-metallic oxides. The nanoparticles will be characterized by Professors Rakesh Gupta of WVU and Lynn Walker of CMU. Examining the stability and rheology of the nanofluids will be the responsibility of Professor Walker while Professor Gupta will measure the thermal behavior and some flow behavior of these liquids. Professor Lee White at CMU will be in charge of the modeling of the transport properties of nanofluids. All the participants will be involved in optimizing the overall behavior of the nanofluids with a view toward developing a practically useful drilling fluid.

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NETL, WVU to Assess Potential for Coal-Derived FT Liquid Fuels for Low-Emission Engine Performance

Engineers from NETL's Office of Research and Development and researchers from West Virginia University have begun a collaborative effort to evaluate Fischer-Tropsch (FT) liquid fuels for use in Homogeneous Charge Compression Ignition (HCCI) engines. HCCI combines the high efficiency of the diesel cycle with ultra-low emissions. FT fuels provide a coal-based alternative to petroleum-based fuels and may provide the desired combination of properties to enable practical HCCI engine technology. The work will provide a literature review, recommend additional research required to enable FT fuels to be used in HCCI applications, and provide a candid assessment of FT fuels' ability to fill this need.

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netlog is a quarterly newsletter which highlights recent achievements and ongoing in-house research at NETL. Any comments or suggestions, please contact Paula Turner at paula.turner@netl.doe.gov or call 541-967-5966.